Topic Page: Mass extinction

Definition: **MASS EXTINCTION** from *A Dictionary of Entomology*

Disappearance of Taxa of plants or animals from fossil record during relatively short intervals of geological time. Examples: Late Cambrian mass extinction of Trilobites, late Permian mass extinction of marine invertebrates; Late Cretaceous Period mass extinction of dinosaurs. Cf. Adaptive Radiation. Rel. Geological Time Scale.

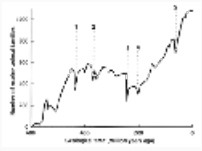

Image from: **The extinction rates in marine animal...** in *The Encyclopedia of Ecology and Environmental Management, Blackwell Science*

Summary Article: **mass extinction**
From *The Columbia Encyclopedia*

the extinction of a large percentage of the earth's species, opening ecological niches for other species to fill. There have been at least ten such events. The five greatest were those of the final Ordovician period (approximately 435 million years ago), the late Devonian period (357 million years ago), the final Permian period (250 million years ago), the late Triassic period (198 million years ago), and the final Cretaceous period (65 million years ago). The most devastating was that at the end of the Permian period, when an estimated 95% of marine species and 8 of 27 insect orders were lost. The best-known mass extinction is that at the end of the Cretaceous period, when the dinosaurs and many other plants and animals disappeared and up to 75% of all marine genera were lost. The most recent mass extinction was that of the late Eocene epoch, approximately 54 million years ago. Understanding and definition of these events have changed rapidly as information from more and more complete fossil samplings is compiled in larger and more comprehensive databases and as computer modeling of such events becomes more sophisticated. For example, studies of the geologic record released in 2007 found that such conditions as an increase in carbon dioxide (and a decrease in oxygen) in the air and a warming of the water in tropical seas are generally associated with mass extinctions.

Theories regarding the causes of mass extinctions abound and are the subject of intense study and debate. In general it is believed that the extinctions resulted from drastic environmental changes that followed events such as meteorite or comet impacts or massive volcanic eruptions. For example, the final Permian extinctions have been linked to huge volcanic eruptions in what is now Siberia. These eruptions, which continued for up to 800,000 years (a relatively short period of time by geological standards), spewed out dust and droplets that blocked the sun, causing global cooling that trapped sea water in the polar ice caps. The levels of inland seas and oceans lowered significantly, eliminating or changing marine habitats. Alternatively, it has been suggested that carbon dioxide and other gases released as a result of the volcanic eruptions may have raised temperatures by 20–50 degrees Fahrenheit (10–30 degrees Celsius) in an extreme greenhouse effect and disrupted ocean circulation patterns, that the gases produced acid rain and depleted the ozone layer, creating conditions inhospitable to many species, or that a combination of the hypothesized effects of the Siberian eruptions was responsible. Other theorized causes for the Permian extinctions include a combination of the effects of the massive volcanic eruptions and huge coal fires ignited by them, the effects of the breakup of the supercontinent Pangaea (which include the huge volcanic eruptions), a large meteor impact, and a supernova that exploded near enough to the earth to bathe it in radioactivity that

destroyed the ozone layer.

The most widely accepted theory of the final Cretaceous extinction is that one or more asteroids or comets hit the earth, lifting massive amounts of debris and sulfur in the air and blocking the sunlight from reaching the earth's surface. In 1980 Walter Alvarez of the Univ. of California at Berkeley found a layer of iridium in sediments that dated from the time of the final Cretaceous extinction. Iridium is rare on earth, but is concentrated in meteors and comets. In 1991 the Chicxulub crater was discovered on the Yucatán peninsula in Mexico. Some 180 km (112 mi) wide, it is wide enough to have been created by the 10-km (6-mi) diameter asteroid thought necessary to cause the environmental upheaval required to precipitate a mass extinction. Large amounts of sulfur found in the Chicxulub soil lend credence to the hypothesis that sulfuric acid dispersed into the atmosphere after the collision creating a dense haze that could have cooled the earth by 20 to 30 degrees Fahrenheit (10–17 degrees Celsius). Some scientists believe global wildfires that incinerated as much as one quarter of the earth's vegetation followed the impact. Other impacts at about the same time, such as that that created the 15-mi-wide (24-km) crater at Boltysh, central Ukraine, may have contributed to the mass extinction at the end of the Cretaceous.

Another theory concerning the cause of the final Cretaceous extinction is that it resulted from the environmental effects of the huge volcanic eruptions that created the lava flows of the Deccan Traps in what is now India. It is possible that both the impact and the eruptions may be responsible for the Cretaceous extinctions. One model suggests the eruptions devastated much marine life some 200,000 years before the impact extinguished the dinosaurs. Another theory suggests (both for the Permian and Cretaceous extinctions) that shock waves from the impact of a large asteroid moved through the earth, shaking the earth's crust and triggering or intensifying the volcanic events.

In addition to eradicating large percentages of both land and sea creatures, mass extinctions also opened new ecological niches, permitting surviving species to thrive in new habitats and encouraging diversity. The extinctions, however, did not conform to the usual evolutionary rules regarding who survives; the only factor that appears to have improved a family of organisms' chance of survival was widespread geographic colonization at the time of the event.

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